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DESERT ROCK V

TOWER SHOT

EXERCISE

DESERT ROCK V

SECRET

SECURITY INFORMATION

COPY NUMBER 00017
VOLUME I - OPERATIONS

MILITARY RESEARCH & APPL

RESTRICTED DATA
ATOMIC ENERGY ACT 1946

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STATION LIST

STATION COMPLEMENT

6012 ARMY SERVICE UNIT (DET F)

6020 ARMY SERVICE UNIT

SUPPORT UNITS

23rd Transportation Truck Company

26th Transportation Truck Battalion (Hq & Hq Company)

31st Transportation Truck Company

38th Transportation Truck Company (Detachment)

53rd Transportation Truck Company (Detachment)

50th Chemical Service Platoon

77th Army Band

93rd Army Band

94th Medical Detachment (Vet Food Insp)

163rd Quartermaster Laundry Detachment

360th Engineer Utilities Detachment

371st Evacuation Hospital (SMBL)

412th Engineer Construction Battalion

505th Military Police Battalion (Company C)

505th Signal Service Group (Composite Company)

705th Engineer Field Maintenance Platoon

762nd Quartermaster Subsistance Supply Company

3623rd Ordnance Company

PARTICIPATING UNITS

Composite Units	First Army
Composite Units	Second Army
Composite Units	Third Army
Composite Units	Fourth Army
Composite Units	Fifth Army
Composite Units	Sixth Army
Composite Units	U.S. Air Force

U.S. Marine Corps Provisional Atomic Exercise Brigade

Camp Desert Rock Troops

6

IV. PARTICIPATION.

Military personnel participated in nine shots during Exercise DESERT ROCK V. Troop observers were included in all shots and composite Battalion Combat Teams participated in six of the nine shots.

The tactical situation assumed for troop participation was based on the concept that Aggressor airborne troops, after an initially successful attack, were now on the defensive and had established a strong position which was holding up the attack by friendly troops. Decision was made to use atomic weapons to force a breakthrough. In each case the actual burst represented one burst out of a group of 5 to 7 employed to execute the planned maneuver.

In each case ground zero was assumed to be 1,500 yards in rear of the enemy lines. Protective trenches were prepared and occupied at 3,500 to 4,000 yards from ground zero in all tower shots and at greater ranges for air dropped and artillery delivered weapons. In planning the maneuvers all tower shots, regardless of KT yield, were assumed to be artillery delivered atomic weapons.

The first atomic explosion in this series occurred on 17 March 1953. This was a tower shot which developed a yield of 16.3 KT and was followed by an attack on an objective to the left (west) of zero from trench positions 3,500 yards from ground zero. This attack was made by two Army BCT's composed of Camp Desert Rock permanent party personnel.

On 24 March two Army BCT's composed of personnel from Second, Third, Fifth, and Sixth Armies entrenched ..,000 yards from GZ attacked an objective to the west of ground zero immediately after the second atomic burst, a tower shot of 24.5 KT yield. In addition, a group of nine volunteer Army, Air Force, and Navy officers were positioned in a trench at 2,500 yards from ground zero as the first step in an experiment to determine how close personnel may be positioned to a burst without harmful effects.

There was no military participation in the third atomic detonation on 31 March 1953. The experimental device used on this occasion developed a yield of only .21 KT.

No military personnel were scheduled to observe the air drop of an atomic weapon on 6 April. However, 75 Marine Corps officers scheduled to participate in Shot V-5 took advantage of the opportunity to witness this detonation in order to be better qualified to orient their troops. They were joined by 60 officers and enlisted men of Camp Desert Rock who had not previously witnessed an atomic detonation. This weapon, yielding 10.8 KT, was detonated 6150 feet above the terrain, and was one of the most spectacular of the series.

The area to be used for Shot V-5 was contaminated by the detonation of Shot V-4. As a result Shot V-6 was advanced to 11 April. The detonation of this device, placed in a cab on a 100 foot tower and which yielded .22 KT, was witnessed by 63 observers originally scheduled to observe Shot 5 but who departed their home stations prior to receipt of the notice of the change in date.

The USMC Provisional Atomic Exercise Brigade formed into two Battalion Landing Teams totaling 2,318 officers and enlisted men, attacked toward ground zero after the detonation of Shot 5 on 11 April. In addition, a Marine Corps Helicopter Group airlifted one company to the vicinity of their objective. This weapon was placed in a cab on top of a 300 foot tower and developed a yield of 27.7 KT. A group of 6 Army and 6 Marine Corps officer volunteers were positioned in a trench 2,000 yards from ground zero to observe this burst. All withstood the atomic blast without incident.

Shot 7, the largest in the series was detonated on 25 April. This shot, an atomic device placed in a cab on top of a 300 foot tower, developed a yield of 51.5 KT. Troops from the Second, Fourth Fifth, and Sixth Armies, organized as two BCT's attacked toward objectives to the west of ground zero immediately after the detonation. These troops were halted 2,000 yards from ground zero because of the high radiation intensity in the area. Seven Army and one Navy officer volunteers were positioned in two trenches located 2,300 yards from ground zero. No unusual effects were noted by these officers.

On 8 May, a Mark 6 stockpile weapon was air dropped and detonated at a height of 2,423 feet above the terrain. This weapon, scheduled as Shot 9, is estimated to have developed a yield of approximately 26.4 KT. Two BCT's composed of personnel from the First, Third, and Fourth Armies plus a contingent of 326 officers and enlisted men of the Air Force attacked toward ground zero immediately after the detonation. A group of 60 of these officers and enlisted men were air lifted by helicopter to a point 1,500 yards from ground zero. This group reached ground zero one hour and two minutes after the detonation occurred.

Shot 8, which had been rescheduled because of contamination of the area, was detonated on 19 May. This device placed in a cab on top of a 300 foot tower developed an estimated yield of 34 KT. A total of 903 military personnel observed this detonation and the resulting effects on equipment, emplacements and animals.

Exercise DESERT ROCK V reached its climax with the detonation of a Mark 9 atomic shell delivered by a 280-mm artillery gun on 25 May. Two RCT's composed of troops from all the continental armies, attacked towards objectives beyond ground zero after the detonation. The Secretary of the Army, two Members of Congress, the Chief of Staff of the U.S. Army, the Chief of Army Field Forces, the Commanding General of Sixth Army and 787 additional military and civilian personnel observed the detonation from positions in the troop entrenchment area.

A total of 17,696 military and civilian personnel witnessed the nine detonations in which the military participated. This total includes the Exercise DESERT ROCK Control Group which participated in all shots. All of the services were well represented throughout the series, with the total participation for each as follows:

Army	13,364
Navy & USMC	2,921
Air Force	1,273
Civilian (All services)	139

V. PSYCHOLOGICAL REACTIONS OF TROOPS AT THE DESERT ROCK V MANEUVERS.

The investigation of troop psychological reactions at the DR-V maneuvers was undertaken by Army Field Forces Human Research Unit No. 2. Research personnel from this unit were present at all shots attended by provisional battalion combat teams composed of Army personnel. The research performed was designed to accomplish the following objectives:

Observation of troop behavior in the forward trench area immediately prior to and during the detonation of an atomic device.

Measurement of changes in troop attitudes and level of information about atomic warfare before and after participation in the indoctrination and maneuver at DR-V.

Assessment of some of the factors governing the degree to which information gained and attitudes formed at DR-V by troop participants were communicated to home station troops upon return of the maneuver participants.

Obtaining reactions and opinions of a group of officers who were in a special forward volunteer group on some of the shots.

At this date only preliminary analyses have been made of the data collected at DR-V. Consequently, the findings reported here should be regarded as tentative. A final report of the psychological findings will be published under separate cover at a later date.

Preliminary findings indicate:

There was no evidence of panic or even overwhelming anxiety on the part of participating troops.

That participating troops acquired considerable information by the end of the exercise which resulted in a decrease in self-rated anxiety about the danger of injury from all the effects of an atomic burst, except radiation. However, there is little evidence that the experience of the exercise produced changes in broader attitudes about atomic warfare, troops interviewed indicating they were neither more nor less willing for the United States to use atomic weapons in Korea.

That more information is gained by participants who, at their home stations prior to departure to the exercise, participate in group discussions and are provided with lists of questions that members of the group desire answered.

That well indoctrinated officers are willing to position themselves in forward trenches located at distances they have calculated to be safe. That such officers feel that they have learned nothing new about atomic effects but by their actions have added to the confidence of participating troops in this and future exercises.

prior to the shot. This period was limited to a description of the tactical maneuver situation for the shot, presented by the AC of S, G3, and a brief general orientation and question conducted by an instructor.

The following subjects were covered in orientations during the exercise period:

SUBJECT	REVISED TIME
Introduction and Security	30 min
Atomic Weapons Family	50 min
Characteristics and Effects of an Atomic Explosion	50 min
Medical Aspects	30 min
Protective Measures and Radiac	30 min
Army Delivery Means	40 min
Air Force Delivery Means	35 min
Navy Delivery Means	35 min
Tactical Employment	80 min
History of Desert Rock Exercises	20 min
Seminar and "TUMBLER/SNAPPER" Film	30 min

Training films concerning atomic matters were shown at night for RCT and officer personnel on a voluntary attendance basis.

The orientation periods were revised continuously as new material became available to the instructors. Lessons learned from experience and suggestions from officers operating in the field of atomic energy who attended the orientations contributed to the improvement of the orientations.

X. RADIOLOGICAL SAFETY.

The Directive for Exercise DESERT ROCK V, issued by OCAFF, made the Exercise Director solely responsible for providing radiological safety for all participants in the exercise. This marked the first time the military was given the entire responsibility for radiological safety of its personnel in maneuvers conducted in connection with an atomic burst.

The Directive provided the Exercise Director with criteria to be used in exposing participants to atomic weapons effects. These criteria provided for a maximum permissible dosage of six (6) roentgens for the exercise.

Based upon the above criteria the Rad-Safe Officer prepared an SOP for Radiological Safety covering all operations in the forward area. These procedures prescribed the use of radiac instruments and film badges, monitoring requirements and decontamination regulations.

Prior to each shot the Radiological Safety Section conducted a school for monitors selected by the participating RCT's. During the maneuver following each shot these monitors checked for nuclear radiation in the area used by their respective units. In addition, the Rad-Safe officer and his monitors surveyed the entire maneuver area, reported intensity levels to the Exercise Director, and exercised overall radiological safety control.

Prior to each shot the Rad-Safe Section placed film badges in the field fortifications located in the display area. These badges were recovered after the shot and the readings were studied to determine the radiation dosages received in the fortifications. In addition, where possible, these readings were compared with radiation effects predicted by trained staff officers.

After each shot radiological surveillance of the area was continued, decay predictions made, and a situation map showing intensity levels was maintained.

XI. PREPARATION OF MANEUVER AND DISPLAY AREAS.

The 412th Engineer Construction Battalion was assigned to Camp Desert Rock for the purpose of constructing troop trenches and preparing the display areas for Exercise DESERT ROCK V. In addition, this unit was to render engineer support, in so far as its capabilities permitted, to the Directorate of Weapons Effects Tests, AFSWP and to Camp Desert Rock.

Preparation of the Exercise DESERT ROCK V sector of each shot area required the expenditure of 26,361 man hours and 7,700 equipment hours during the period 12 January to the detonation of Shot 10 on 25 May. Approximately 10,000 feet of trenches were dug for Shot V-1, V-2, V-5, V-7, V-9, and V-10 with Shots V-6 and V-8 requiring a lesser amount.

All display areas contained a standard layout of stakes, shallow trenches and bunkers, beginning at 500 yards from Ground Zero and at each 500 yards thereafter up to 3,500 yards. The following emplacements and stakes were placed on each 500 yard arc:

C-1 (C-9) Stake - A 4" x 4" wooden stake, extending 2' above the ground. Fig 1 (Page 77).
C-2 (C-8) Trench - A slit trench 4'6" long, 2' wide and 2' deep. Fig 2 (Page 77).
C-3 (C-7) Trench - A slit trench 4' long, 3' wide and 3'6" deep. Fig 3 (Page 77).
C-4 (C-6) Bunker - A one man covered emplacement. Fig 4 (Page 78).
C-5 "B" Bunker - A two man covered emplacement. Fig 5 (Page 79).

In addition, deep "A" type bunkers were dug at 100, 200, and 300, and 400 yards from ground zero for Shots V-2 and V-4. Various items of military equipment were also placed in the display areas to provide visible evidence of the damage effects of atomic weapons. Sheep were placed in selected A, B, and C type emplacements. Fig 6 (Page 80).

The Engineer support rendered to AFSWP TEST GROUP required an expenditure of 12,209 man hours and 2,318 equipment hours up to 25 May 1953. This effort was largely expended in the Frenchman Flat area.

Engineer support rendered to Camp Desert Rock for the construction of additional facilities required the expenditure of 17,929 man hours and 614 equipment hours.

The clean up of destroyed equipment in display areas for Exercise DESERT ROCK V and AFSWP will require additional effort.

Communication facilities for Exercise DESERT ROCK V were installed by Composite Company, 505th Signal Group. These facilities included telephone communication between the Control Group and the BCT Commanders, ADC Control Point, the vehicle parking areas, Camp Desert Rock and a forward line to Rad-Safe monitors. In addition, a radio net was established to duplicate the telephone system. A public address system was constructed in each trench and vehicle parking area to enable instructors to give "on site" orientation and instructions to the participants. The establishment of these communications facilities required the expenditure of 7,776 man hours and 2,340 equipment hours.

This unit also expended 10,080 man hours and 2,450 equipment hours in support of Project 3.20 (SIGNAL) in the AFSWP test area. This effort was expended in the construction of pole lines, buried lines, surface lines and construction of radio towers.

XII. VOLUNTEER OBSERVER PROGRAM.

Selected officer volunteers, capable of calculating effects of atomic weapons, were positioned in trenches at 2,500 and 2,000 yards on three shots.

Four Army, four Naval and one Air Force officer volunteers were positioned in a heavily revetted trench located 2,500 yards from ground zero on Shot V-2. For Shot V-5, the volunteer trench was located 2,000 yards from ground zero and was not revetted. This trench was occupied by 6 Army and 6 Marine Corps Officers. Two trenches, one revetted and one not revetted, located at 2,000 yards from ground zero were utilized by the volunteer officer group on Shot V-7. This group consist seven Army and one Naval officer.

The location of the trench in each case was based upon the determination of a safe distance by the volunteers. This distance was calculated for the criteria under which the program was established, using effects data listed in TM 23-200 dated 1 Oct 1952. These criteria, established by OCAFF, were:

"Overpressure	8 psi at ground level."
"Thermal	1 cal/cm^2".
"Nuclear radiation	10 r in any one test, of which no more than 5 r is prompt, whole body radiation, and with the further limitation that no volunteer shall take more than 25 r in this series of tests."

All calculations were based upon the above criteria and the predicted yield of the weapon to be detonated. The actual yield was less than the predicted yield for Shots V-2 and V-5, but exceeded the predicted yield of 40 KT by 25 percent on Shot V-7.

As a result of their experience these officer volunteers concluded:

That the volunteer trenches were located at a safe distance under the given conditions for each shot.

That data in TM 23-200, dated 1 October 1952, can be used to determine safe observer positions if properly qualified officers make the computations.

That troops could have observed these shots safely from positions located in the same areas as the volunteer trenches. However, it was further concluded that troops should be placed no closer than 3,500 or 4,000 yards to ground zero in troop orientation and indoctrination exercises, such as Exercise DESERT ROCK V, for the following reasons:

Troops can feel the effects of the detonation at those distances as well as they could at a closer point.

Troops can better observe the fireball and mushroom cloud at these distances.

Troops are sufficiently removed from the heavy dust cloud and possible radiation hazard.

Reduction of the distance between ground zero and the troop entrenchment area below 3,500 to 4,000 yards reduces the area available for troop maneuvers.

That a trench six feet deep and unrevetted gave adequate protection under the given conditions.

That there was no discomfort from blast or thermal effects.

That ground shock, at this distance, is not of sufficient magnitude to be of any concern.

That the existing volunteer program, with its present mission and limiting criteria, has served its purpose and should be discontinued.

That a volunteer program of this type, with a mission of indoctrination for personnel having special weapons training or assignments with special weapons programs, would be worthwhile.

That future volunteer programs would have greater value if volunteers were positioned in a variety of standard field fortifications and combat vehicles approximating actual combat conditions.

That instrumentation placed in trenches to record pressures, heat, ground shock, and nuclear radiation would be of assistance in evaluating observers reactions.

Study of the results of the volunteer program must be done with great care. Readers are cautioned to remember that all shots in which volunteers participated were tower shots. Different information might result if a similar program were undertaken for shots in which the detonation took place considerably higher than the 300 foot height of the tower used in these shots.

XIII. CONCLUSIONS.

From experience gained in Exercise DESERT ROCK V it is concluded:

That the overpressure and thermal radiation criteria used in determining troops positions for this exercise are sound and should be followed in future exercises.

That the criteria for nuclear radiation to be accepted should be increased to permit maneuver closer to ground zero than was possible in this exercise. The amount of increase should be determined by observation of the volunteer officers who accepted larger dosages than permitted for troop participants.

That the criteria for distances between ground zero and the troop trenches used in this exercise are sound and should be retained in future exercises.

That a volunteer program which would permit officers trained in special weapons or assigned to special weapons programs to be positioned in trenches closer to ground zero than the participating troops would be worthwhile for indoctrinating such officers in atomic weapons effects.

That atomic weapons effects data found in TM 23-200, dated 1 October 1952, can be used by qualified officers to determine safe troop positions and to predict damage to equipment, emplacements and personnel as the result of an atomic weapon detonation.

That indoctrinated soldiers show no evidence of fear of an atomic detonation and will willingly attack objectives at or near ground zero.

That continued detonation of atomic weapons over the same flat terrain found in the Yucca and

Frenchman Flats of the Nevada Proving Ground precludes the obtaining of valuable data on the effects of atomic weapons detonated in rough terrain and under other than ideal conditions.

That improved military participation could be obtained by more direct contact between the Exercise Director and the Test Manager, AEC Nevada Proving Ground, rather than the Exercise Director being required to communicate through AFSWP to the Test Manager.

That emphasis in future atomic weapons tests should be placed upon tactical operations rather than weapons effects in order to increase our knowledge of the tactical employment of nuclear weapons. Although a great deal of theoretical work has been done on the tactical employment of nuclear weapons, a great deal remains to be done. Ultimately, and with as little delay as possible, armored and infantry divisions should attack behind multiple atomic detonations which have been incorporated into a fire plan involving all of the conventional weapons. A vast amount of data is presently available on weapons effects.

That the assignment of a photodosimetry team and laboratory to Camp Desert Rock would have made more accurate and complete Rad-Safe operations in Exercise DESERT ROCK V.

That dependence upon Camp Mercury sources for photographic coverage of Exercise DESERT ROCK V is unsatisfactory.

XIV. RECOMMENDATIONS.

To improve future Exercises DESERT ROCK, it is recommended:

That the overpressure and thermal criteria used in this exercise be retained.

That the nuclear radiation tolerances be increased to permit maneuver closer to ground zero.

That troops entrenching positions be located no closer to ground zero than 3,500 to 4,000 yards.

That future exercises of this type include a volunteer observer program with a mission of indoctrination for officers having special weapons training or assignments in special weapons programs, and that such a program be expanded to include larger numbers and less stringent prerequisites for participants.

That future exercises include attacks against fortified positions located in rough terrain, utilizing stockpile weapons that would be used under similar conditions in combat where possible.

That future exercises employ standard atomic weapons under adverse weather conditions to determine the effectiveness of these weapons under such weather conditions from offensive and defensive points of view.

That Department of the Army obtain the necessary authority to secure and utilize limited numbers of stockpile weapons in exercises for which it is completely responsible and which are free from artificial test detonations, equipment and electronic measuring devices.

That planning be started for a large scale exercise, employing two or more divisions attacking a simulated enemy after detonations of multiple burst of stockpile weapons and in conjunction with the coordinated fire of conventional weapons.

That the Department of Defense take steps to have greater emphasis placed upon tactical operations and troop participation in any future test series scheduled by the AEC.

That the Exercise Director for future exercises DESERT ROCK be made a deputy to the Test Manager in order to have direct contact on all matters pertaining to troop participation and tactical operations.

That steps be taken to obtain items of display equipment through technical service channels at least 4 months prior to the first shot.

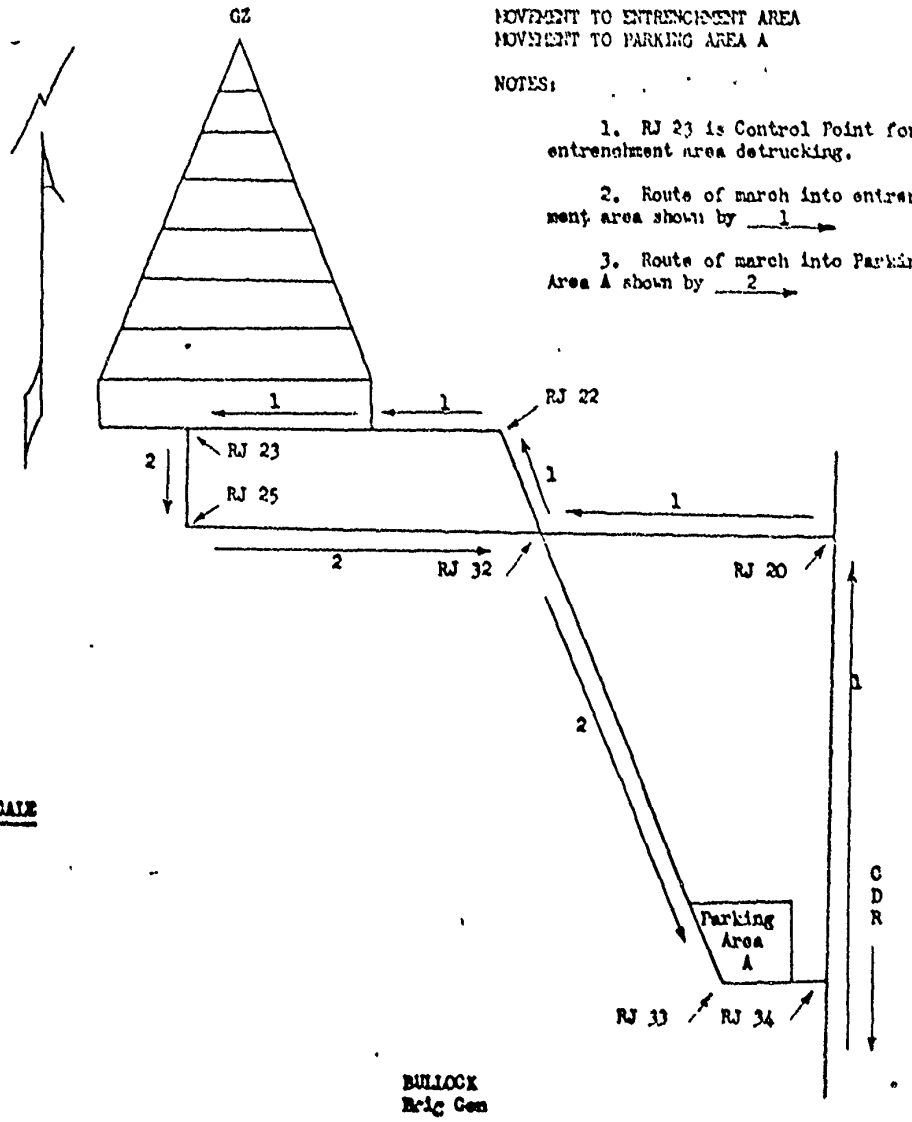
That the quotas for troop observers and BCT's be held at the same level as quotas for Exercise DESERT ROCK V; that is, a maximum of 600 troop observers and two (2) BCT's with a strength of 1,200 each.

That in future exercises a photodosimetry team and laboratory be assigned to Camp Desert Rock.

That steps be taken to obtain AEC permission for Camp Desert Rock photographers to cover Exercise DESERT ROCK activities within the Nevada Proving Ground, with the complete understanding that all photographs will be developed and classified within the Nevada Proving Ground and in conjunction with AEC personnel.

HQ CAMP DESERT ROCK
LAS VEGAS (872536) NEV
211200 April 1953

Appendix A (TRAFFIC CIRCULATION) to Annex 4 (Schedule of Events) to Opn O 4
EXERCISE DESERT ROCK V



MOVEMENT TO ENTRENCHMENT AREA
MOVEMENT TO PARKING AREA A

NOTES:

1. RJ 23 is Control Point for entrenchment area detrucking.

2. Route of march into entrenchment area shown by 1

3. Route of march into Parking Area A shown by 2

NOT TO SCALE

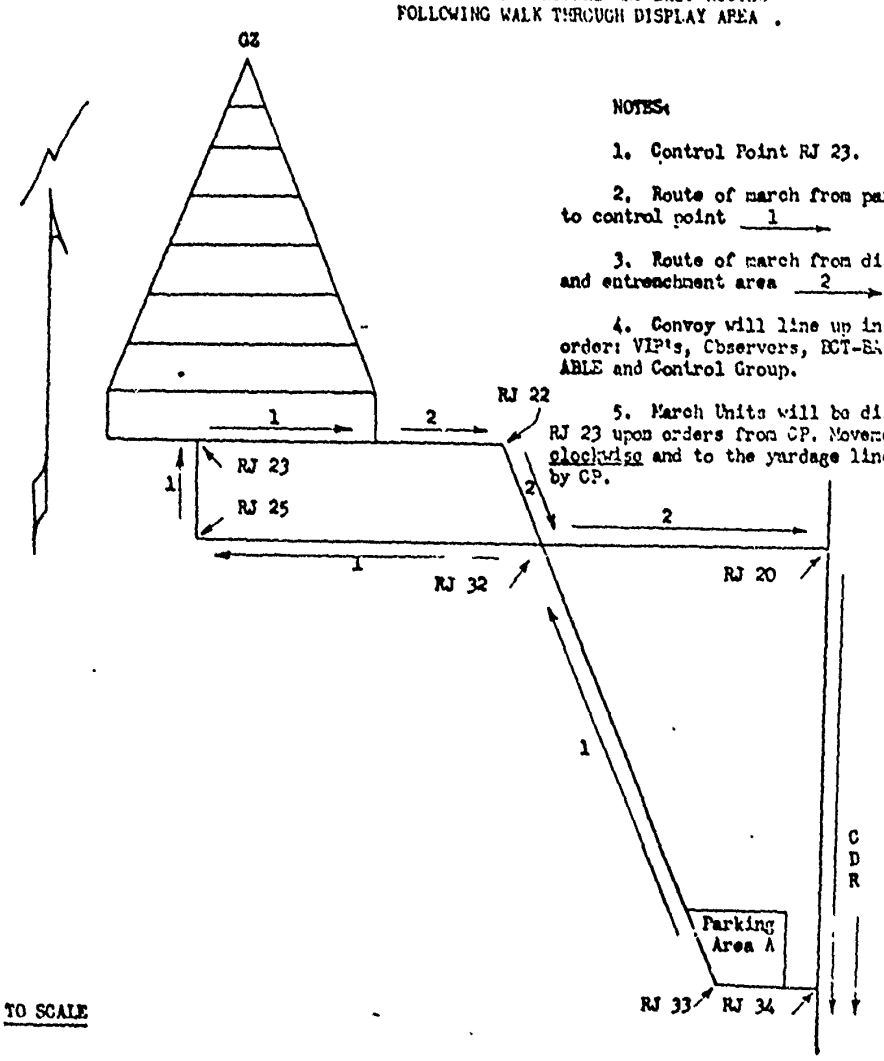
BULLOCK
Brig Gen

OFFICIAL:
Shookus
SHOOKUS
G 3

HQ CAMP DESERT ROCK
LAS VEGAS (8725-36) NEV
211200 April 1953

Appendix B (TRAFFIC CIRCULATION) to Annex 4 (Schedule of Events) to Opn O 4
EXERCISE DESERT ROCK V

LOCATION OF VEHICLES AND EXIT ROUTES
FOLLOWING WALK THROUGH DISPLAY AREA .



NOTES:

1. Control Point RJ 23.

2. Route of march from parking Area A to control point 1

3. Route of march from display area and entrenchment area 2

4. Convoy will line up in the following order: VIP's, Observers, BCT-BAKER, BCT-ABLE and Control Group.

5. March Units will be dispatched from RJ 23 upon orders from CP. Movement will be clockwise and to the yardage line indicated by CP.

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Brig Gen

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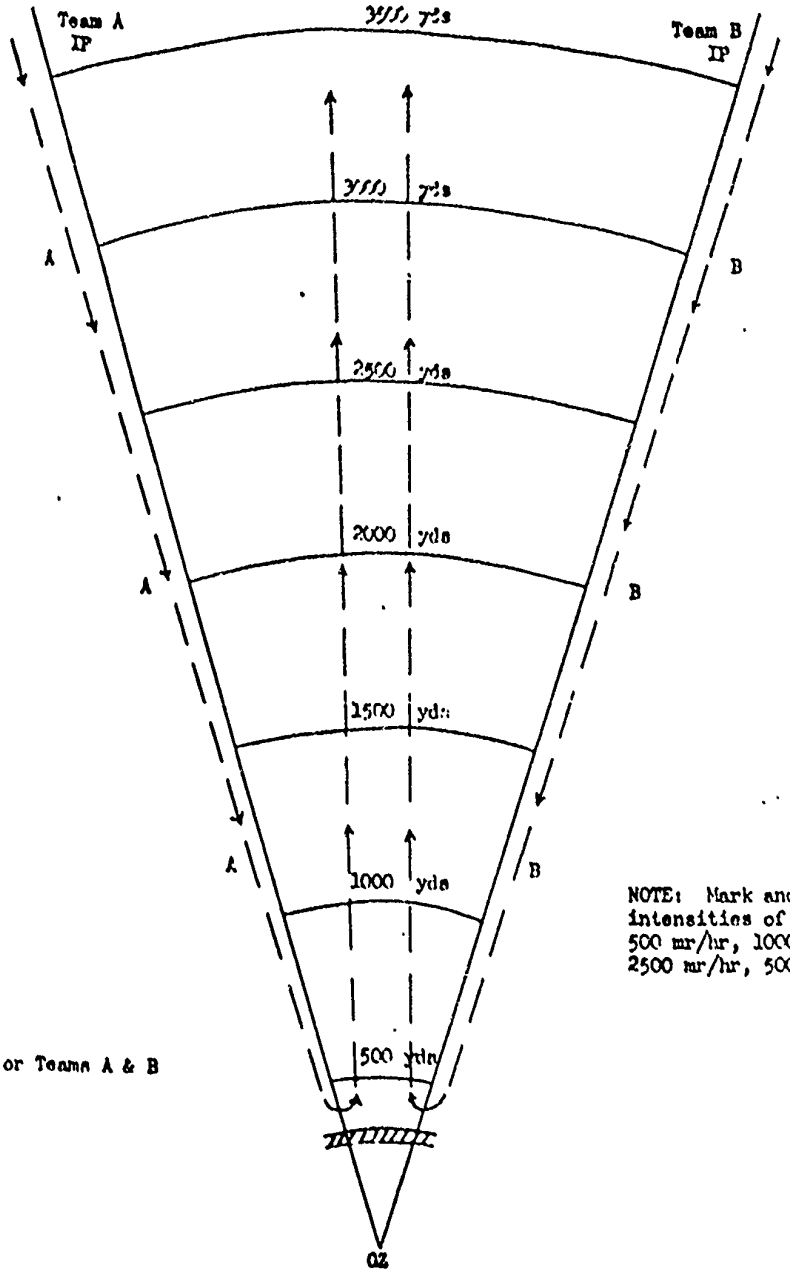
Appendix A (ROUTE OF MONITOR TEAMS) to Annex 7 (Pre-Shot) to Opn O 4
EXERCISE DESERT ROCK V



Route of Monitor Teams A & B

NOTE: Mark and report intensities of 10 mr/hr 500 mr/hr, 1000 mr/hr 2500 mr/hr, 5000 mr/hr

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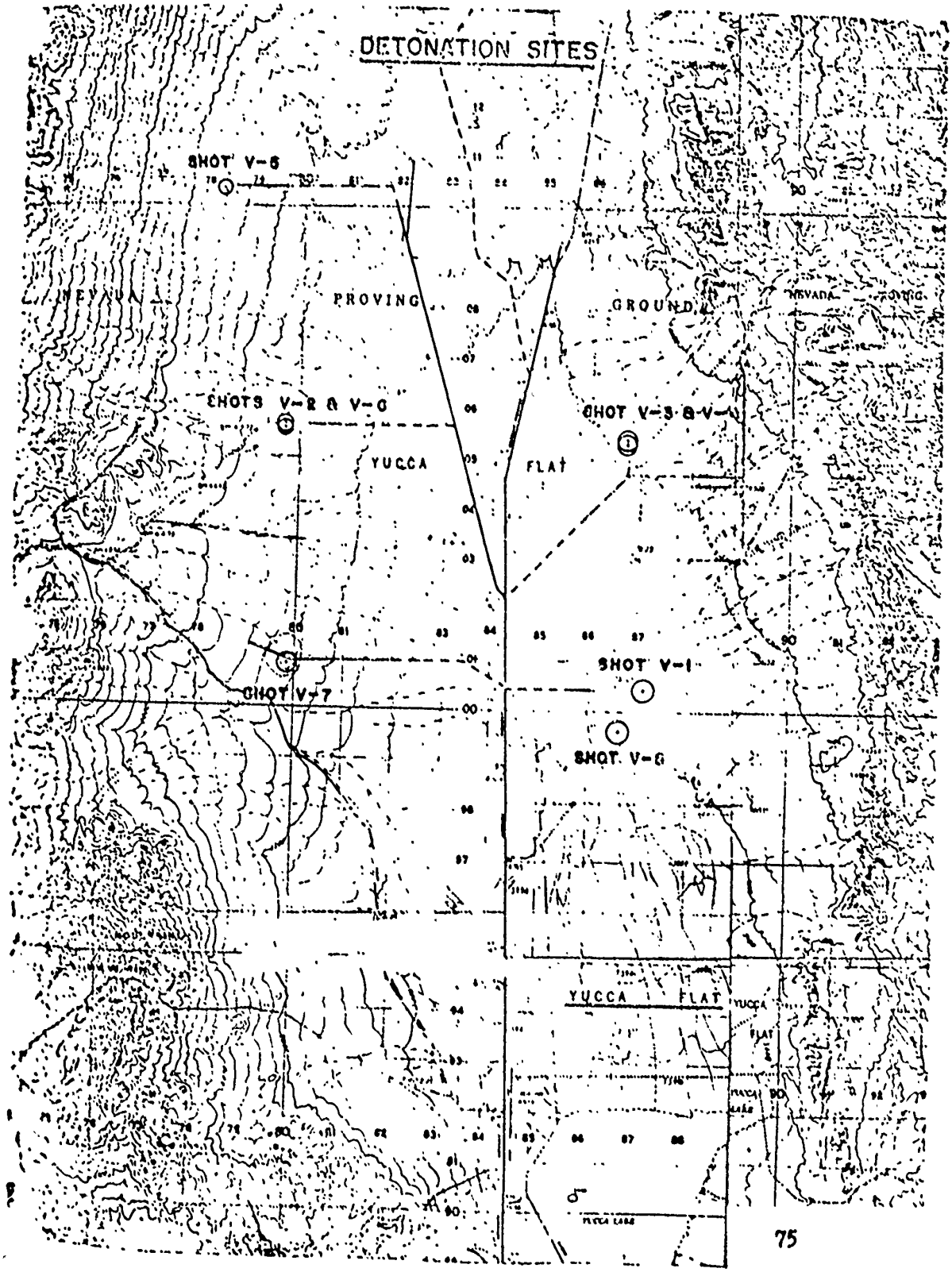

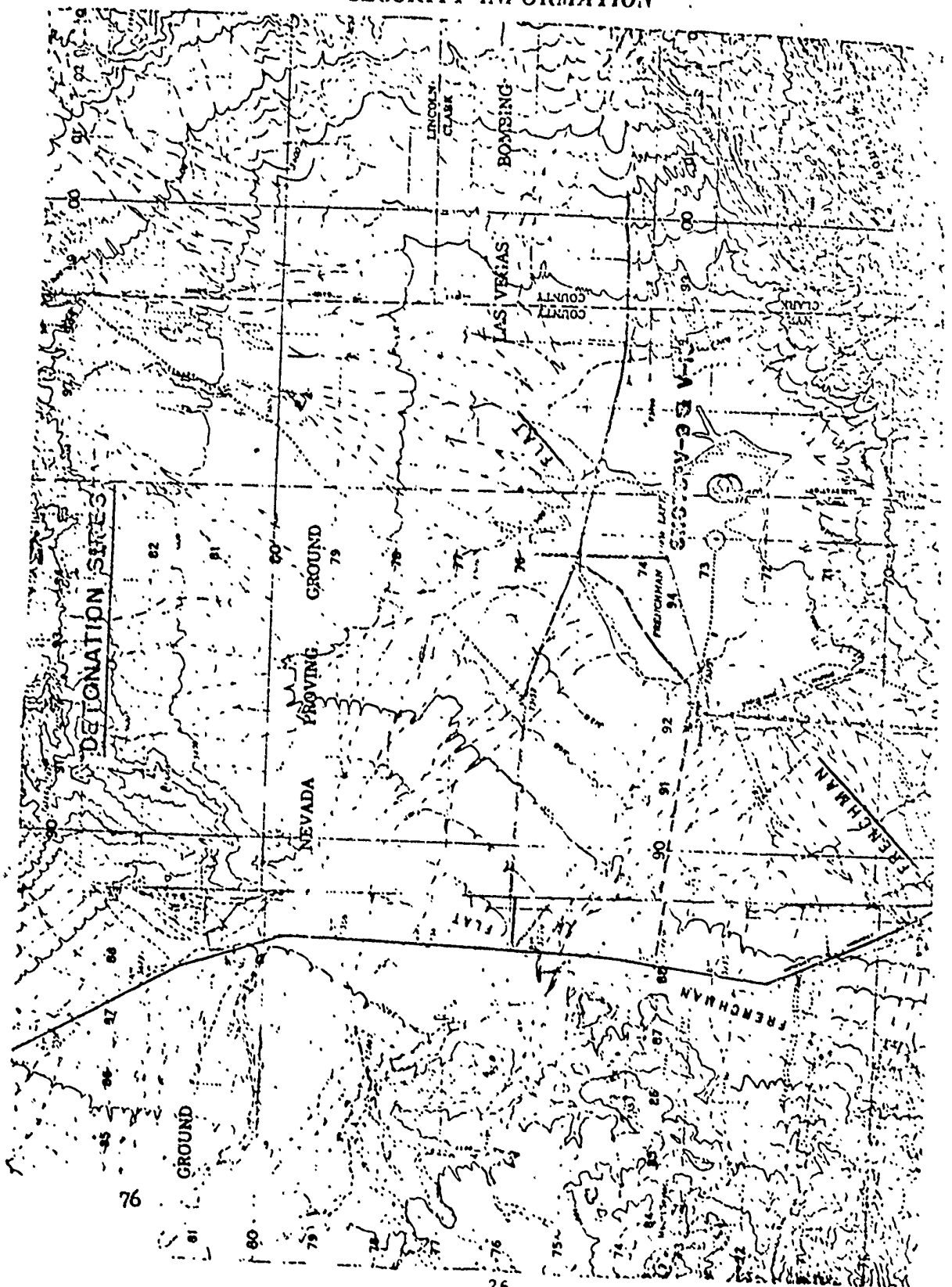
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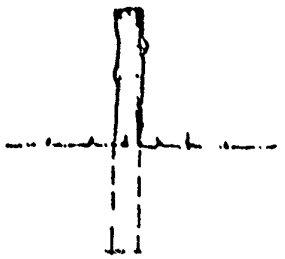
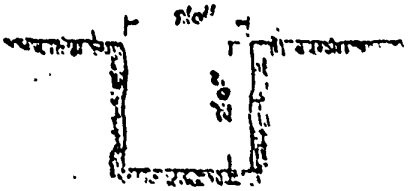
GROUND
76



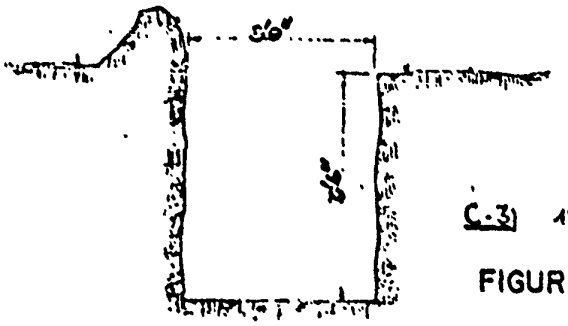
C-1 WOODEN STAKE

FIGURE 1



C-2 4'-0" LONG

FIGURE 2



C-3 1'-0" LONG

FIGURE 3

SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

SANDIA BASE, NEW MEXICO

TEST COMMAND
ARMED FORCES SPECIAL WEAPONS PROJECT

DF'S
DRAWN TA
CHK'
LDR
SUPV
HEAD
UCR
ENGRG'NG
PROJ MGMT

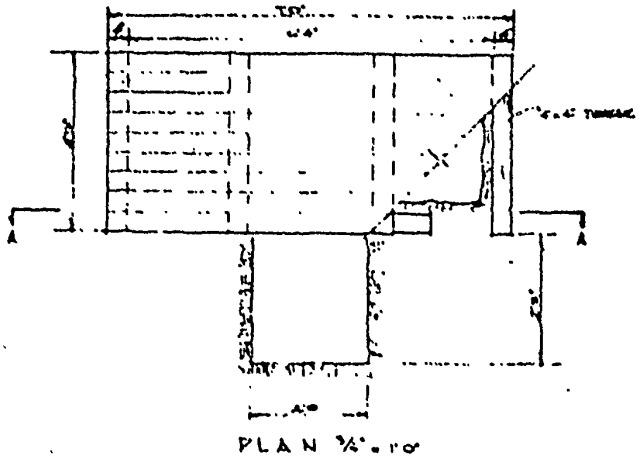
SIXTH ARMY
EMPLACEMENTS

DRAWINGS NO. C-1, C-2, C-3

APPROVED _____ DATE _____
FOR THE COMMANDER

DIRECTOR
SATISFACTORY TO _____
DATE _____

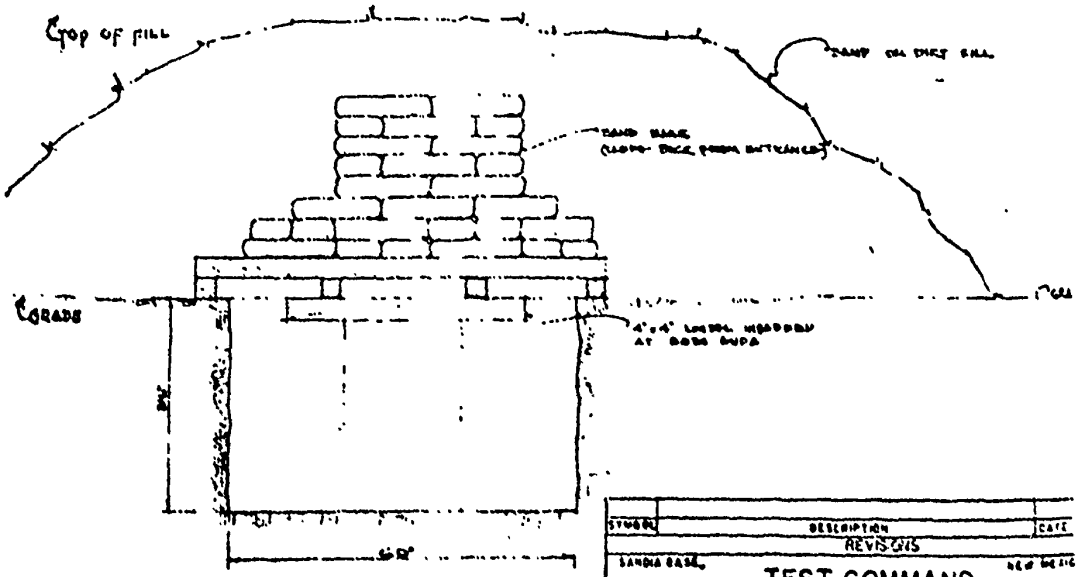
SCALE _____ SPEC
SHEET 1 OF 1 77
E.E. DRAWING NO.



PLAN

C-4

FIGURE 4



SECTION A-A

SYMBOL	DESCRIPTION	DATE
	REVISIONS	

SANDIA BASE — NEW MEXICO

TEST COMMAND
ARMED FORCES SPECIAL WEAPONS PROJECT

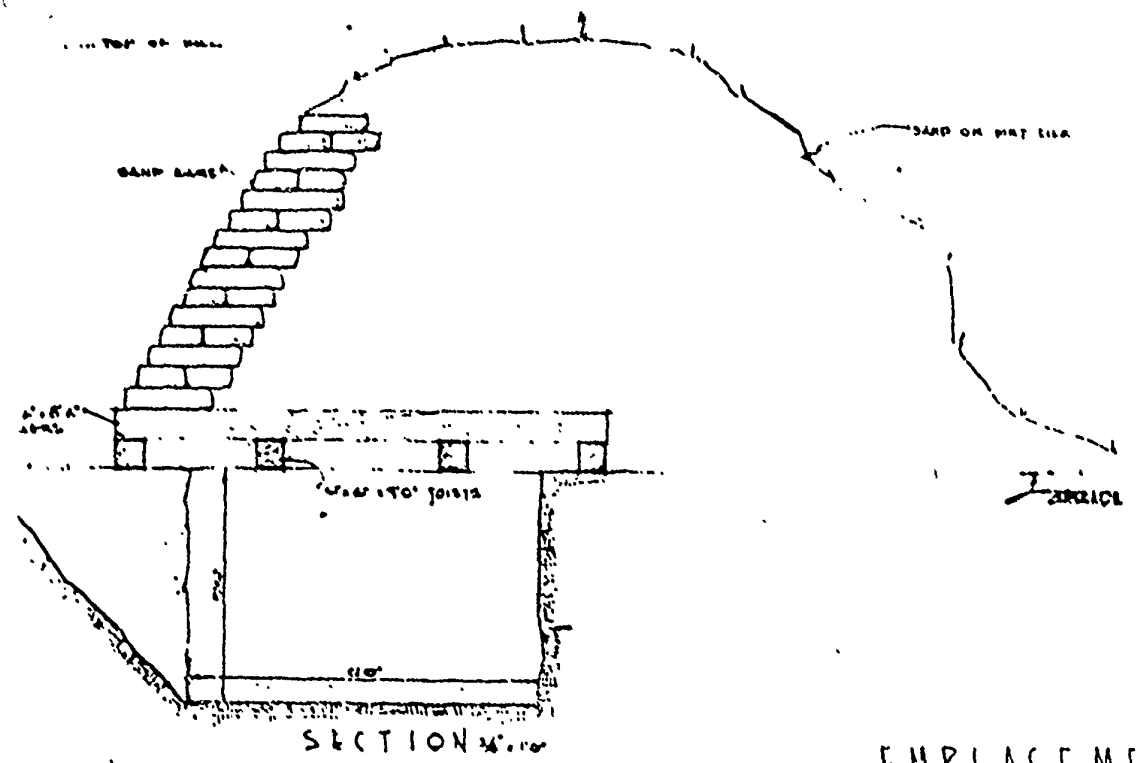
SIXTH ARMY
EMPLACEMENTS

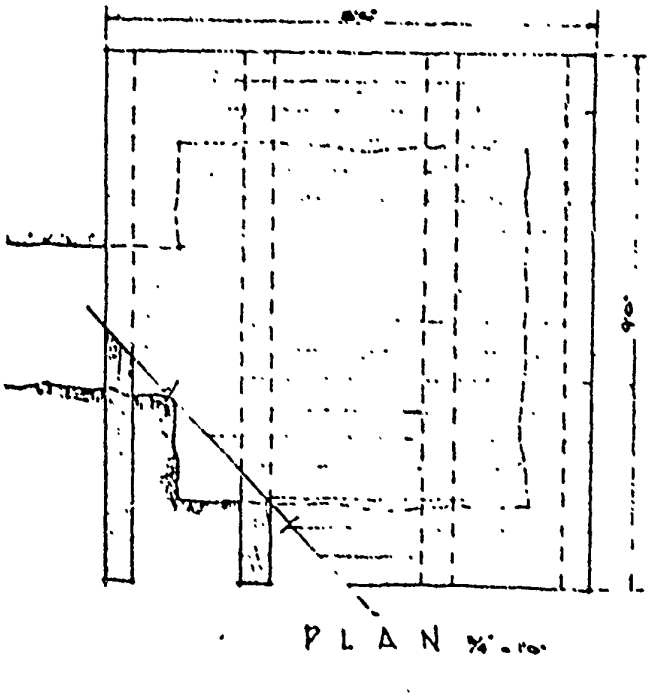
DRAWINGS NO. [redacted] C-4

APPROVED _____ DATE ___
FOR THE COMMANDER

SCALE _____ SHEET 1 OF 1 SHEETS

DIRECTOR
SATISFACTORY TO
DATE

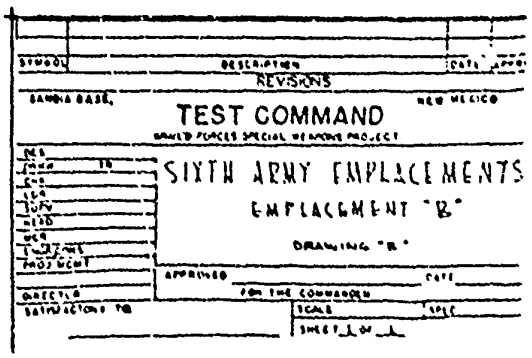




EMPLACEMENT
'B'

C-5

FIGURE 5



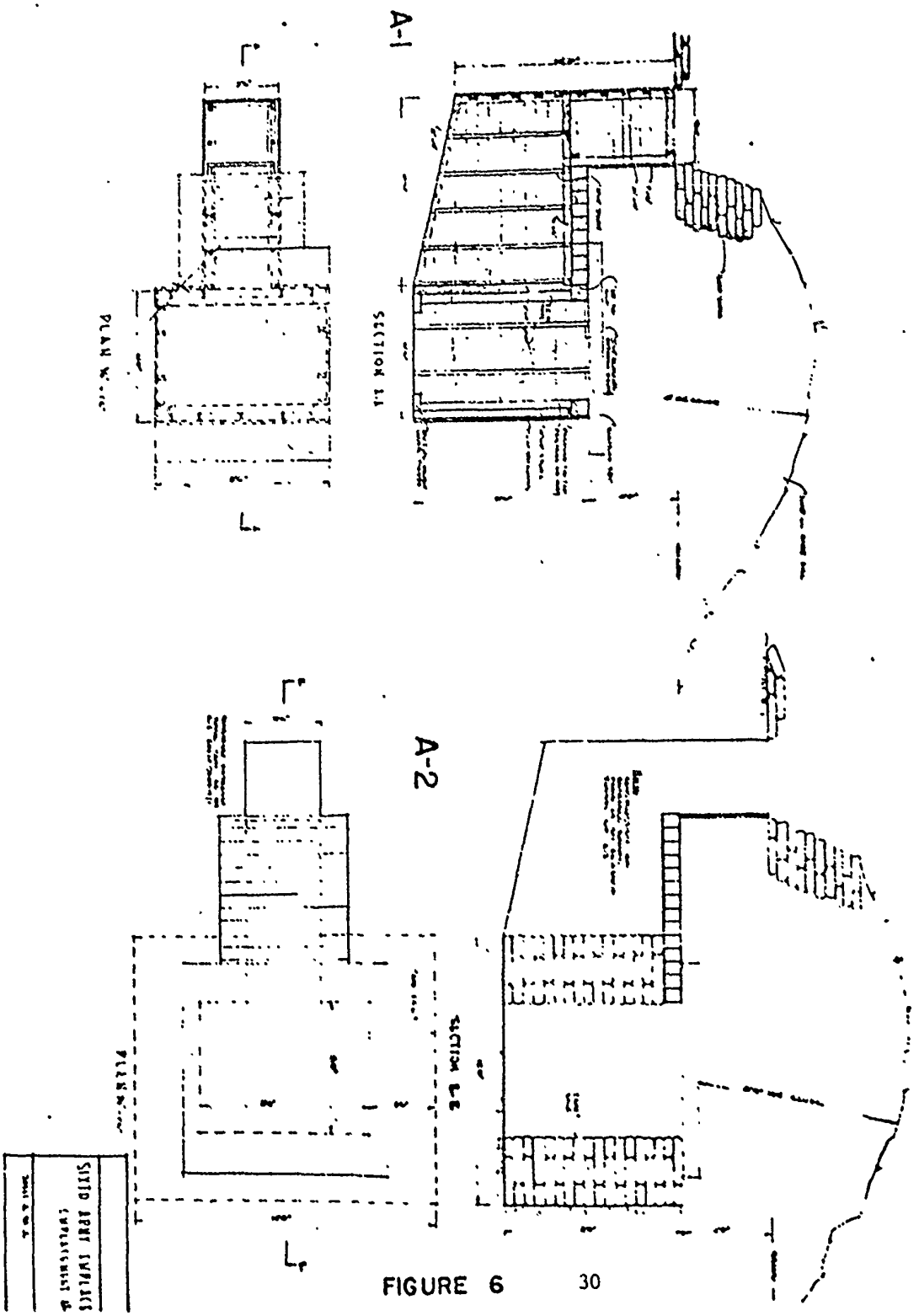


FIGURE 6

A-1 and A-2 Type Emplacements

HQ CAMP DESERT ROCK
LAS VEGAS (872536) NEV
011200 June 1953

Annex 3 (SHOT VICTOR 2) to Final Report
EXERCISE DESERT ROCK V

I. GENERAL.

Incoming observers and troop personnel for Shot 2 closed in Camp Desert Rock on 20 March. Troop participants were from the Second, Third, Fifth, and Sixth Army Areas.

A full dress rehearsal was conducted on 22 March in the Yucca Flat Area, actual site for this shot. The control group departed Camp Desert Rock at 0807 hours and all units closed in the entrenchment area at 1045 hours.

Actual shot day conditions were in order during the rehearsal. One of the RCT commanders experienced some difficulty in placing members of his command in the allotted trenches. Another "dry run" remedied this situation.

The arrival and detrucking of approximately 3,000 officers and men at the entrenching area was accomplished in the one (1) hour allotted for this purpose. It was surprising to note the crowded conditions that existed when troops detrucked in the relatively small area.

The RCT started the simulated attack from the trenches at 1200 hours. The attack continued for 1,500 yards and at that point the advance was halted. This concluded the tactical phase of the rehearsal.

The observers and troop personnel were taken through the equipment and animal display area shortly after the tactical phase ended. Later the observers were taken to the site of Shot 1 to observe the damage to equipment from a previous detonation.

Movement for return trip started at 1250 hours and all personnel closed in Camp Desert Rock at 1632 hours. The rehearsal progressed on schedule and much experience was gained by the staff in executing this phase of the exercise.

The control group departed camp for Shot 2 at 0041 hours, 24 March. A total of 185 vehicles were required to transport the Control group, observers and troops to the shot site. All personnel closed in the entrenchment area at 0340 hours. Vehicles were moved to a motor park, 8.5 miles from ground zero.

A pre-shot indoctrination and orientation was delivered over the public address system from 0410 to 0500 hours.

At H-Hour minus 10 minutes the Exercise Director ordered all personnel into the trenches.

At H-Hour minus 2 minutes, all personnel were ordered to crouch low in the trenches. A siren blast of 30 seconds duration was sounded at this time.

At H-Hour minus 90 seconds, the Atomic Energy Commission took over the public address system and counted off the remaining time at 30 second intervals until reaching H-Hour minus 10 seconds. Once more came the now well remembered "9, 8, 7, 6, 5, 4, 3, 2, 1 and MARK count" (0510 hrs).

A very bright light, which seemed to linger longer than the light noticed during the first shot, was observed in the trenches. Very little ground shock was received but the noise was deafening. Debris falling into the trenches in large quantities, followed by dust conditions, obscured the vision of personnel. None of the debris was large enough to cause injury.

A large fireball, engulfed in a huge dust cloud, was observed initially. Soon after the blast, the wind direction changed and caused a dust cloud to blow over the troops in the entrenchment area. A reading of 18 mr was noted at the trenches.

At 0533 hours the RCT's attacked objectives 4,000 yards to the north. The unit on the east, nearest to ground zero, had to sidestep to the west as the advance neared ground zero because of radiation intensities. Troops were able to move to within approximately 500-700 yards of their objectives when halted by Rad-Safe personnel as no further advance could be made under the established radiation criteria.

Nine (9) volunteer officers were positioned in a trench 2,500 yards from ground zero during the blast. They were in constant wire communication with the control trench, 1,500 yards to the rear, before, during and after the blast. None of the volunteers experienced any ill effects and all felt their combat efficiency would have been unimpaired.

A Marine Corps Helicopter Group (H-19) conducted experiments during the shot. Four (4) helicopters were on the ground approximately 16,500 yards from ground zero during the detonation. Three (3) of the aircraft became airborne immediately after the detonation and prior to the arrival of the blast wave. One of the airborne aircraft proceeded towards the burst after the arrival of the blast wave and was flown to within 3,500 yards of ground zero. Dust and airborne radiation limited any further movement toward ground zero.

The shock wave produced no adverse effects on either airborne or parked helicopters. It was determined that the initial intence light from a detonation would not noticeably affect the pilot of an airborne helicopter providing the pilot was observing 160 degrees from the blast area.

An Army helicopter (H-23) was used to perform a rapid survey of the equipment and animals in the display area two (2) hours after the detonation. Using this mode of travel, it was possible to proceed to within 400 yards of ground zero.

The observer group departed the entrenchment area at 0631 hours for a tour of the equipment and animal display. Troop units also visited the display area at the conclusion of the tactical maneuver. Shortly after 0800 hours, march units started the return trip and all closed in Camp Desert Rock at 1032 hours.

The maneuver, motor movement and other portions of the exercise were executed according to schedule and without incident.

No damage occurred in protective trenches at 1,500 yards and beyond. Sheep positioned in the open were alive and walking around after the blast. All sand bags, facing ground zero, were burned at this distance.

Participating in the exercise were 2,845 military and 16 civilian personnel, a total of 2,86 persons.

At ground level, in the entrenchment area, at shot time, temperature was recorded at 50.7 degrees Fahrenheit. Wind velocity, from a direction of 310 degrees true north, was 2 knots per hour. Almost simultaneously with the burst, a wind of 4 - 6 knots from approximately 5 degrees developed.

II. INTELLIGENCE AND SECURITY.

The two Battalion Combat Teams arrived properly cleared, were briefed, performed in a most cooperative manner and presented no security problems before, during, or after the shot.

The vehicle convoy was cleared through the forward area more smoothly than on the previous shot.

No spaper representatives were not allowed to be present in the Shot Area for this shot. The problem of safeguarding of classified information was greatly reduced because of the absence of news interviews.

Signal photographers were barred by the Atomic Energy Commission from taking pictures unless the photographers were "Q" cleared. No "Q" clearances have been received for any of the photographers although more than six weeks have elapsed since application for such clearance was initiated. In order for the exercise to receive proper documentation it is extremely necessary that certain photographs of the area be secured. Because of this new ruling Desert Rock must rely on photographers within Camp Mercury, who are already assigned other committments, in order to secure these photographs.

III. INSTRICTOR GROUP.

On 21 March the orientation of one BCT in two groups of approximately 600 men each and the observer group for shot V-2 began. A rehearsal was held on 22 March which included a trip for the observer group to the dirplay areas for Shot V-1. A discussion of the damage to equipment and the general condition of the area of the shot was presented.

The second BCT and remainder of the observer group instruction was completed on 23 March. A

1 hour evening orientation was given to late arrivals. This was followed by a showing of Training Film "Operation TUMBLER-SNAPPER" (SECRET) to all observer personnel, on a voluntary attendance basis. This training film was favorably received. The same evening, in the open air theater, the following training films were shown on a voluntary basis to the BCT's: "The Effects of Atomic Explosion" (RESTRICTED), "Medical Aspects of Nuclear Radiation" (RESTRICTED), "Self-preservation in A-bomb Attack" (RESTRICTED), and "The Great Gun" (UNCLASSIFIED).

Shot V-2 was fired on 24 March and BCT's and observers were conducted through the equipment display area to observe, and receive orientation as to the effects of the detonation.

The conduct of the orientation for shot V-2 was improved both in the training auditorium and the forward area as a result of the use of proper equipment and training aids which were unavailable for shot V-1. Mobile sound trucks were furnished to the instructors with the BCT's to further assist in the orientation and control in the forward area.

IV. SIGNAL.

The requirements for this shot were generally the same as for Shot V-1. A few changes were made to provide a better communication system in the forward area.

Public address loudspeakers were installed on three (3) thirty (30) foot poles in the entrenchment areas. This provided a good coverage for all parts of the trench area.

Once more the battalion commanders were provided AN/PRC-10 radios for command and control purposes. More frequencies were assigned to the Exercise Director and, although radio communication was improved considerably, some transmission difficulty was experienced when the battalions were 2000-3000 yards from the control trench.

A more satisfactory wire communications service was provided in the display area than on Shot 1. This was accomplished by burying the wire along both sides of the equipment display triangle prior to the shot. This wire system terminated at stakes which were located at 500 yards intervals as far forward as 1000 yards from ground zero. Rad-Safe personnel installed telephones at these locations when wire communications with the control trench was desired.

V. RADIOLOGICAL SAFETY.

Shot Day Operations. The 2.5 r/hr limit was reached by the monitors at 850 and 1250 yards from ground zero on the right and left sides of the sector respectively. The 5 r/hr line was less than 100 yards beyond. Intensities ranging from 5 mr/hr upward were encountered over the entire test area. Rad-Safe Operations for Shot 2 were the same as for Shot 1 with two exceptions:

The monitor and marking party trucks were used to transport the volunteer observers to and from their trenches on the 2500 yard line.

A change in the direction of the wind caused part of the radioactive cloud to pass over the trenches. There was no appreciable fall-out in the trench area, but radiation intensities at ground level reached 18 mr/hr while the cloud was overhead. There was rather heavy fall-out of radioactive material in the maneuver area, particularly in a draw which lay between the attacking troops and their objective. The deposit in the draw was of high enough radiation intensity (about 14 r/hr) and of sufficient extend to call for withdrawal of the troops from the contaminated ground. The CDR monitors of the BCT's proceeded into the area without giving any indication of their readings to their unit commanders. Upon being directed by the Rad-Safe Officer, the unit commanders seemed to experience difficulty in withdrawing their men. However, little time was spent in the area. The first of these deficiencies may be attributed to training which emphasizes techniques and does not train the monitor in what to do when radiation fields of high intensity are approached and entered. The second deficiency probably resulted from the provisional organization of the attacking troops.

Special Operations.

Immediate radiation intensities were recorded in the same manner as in Shot 1.

The unexpected fall-out in the area west of Shot 2 ground zero extended over positions being prepared for Shot 5. Since the radiation intensity was approximately 2 r/hr work was discontinued. Prediction of decay rates and calculation of time of stay in the area was necessary to plan for engineer operations. Future intensities and conditional dosages were calculated. Early morning surveys were made daily to check the calculations. It was found that the actual reduction in intensi-

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Annex 6 (SHOT VICTOR 6) to Final Report
EXERCISE DESERT ROCK V

GENERAL.

Shot V-6 was detonated on a 300 foot steel tower at 0445 hours, 11 April. Observers from all services witnessed the explosion from a vantage point on News Nob, a small hill near the Atomic Energy Commission Control Point at the entrance to Yucca Flat. The steel tower containing the nuclear device was located in the west-central portion of Yucca Flat, approximately ten (10) miles from the observers.

This shot was a low yield experiment and no troop exercise was conducted in connection with it. Participating as an observer group from Camp Desert Rock, were thirty three (33) Army, twenty five (25) Marine, four (4) Air Force and one (1) Navy officers. The twenty five (25) Marine personnel were commanders and staff officers of the Marine Corps Provisional Atomic Exercise Brigade who came to Camp Desert Rock as members of the advance party of the Brigade to prepare for Marine participation in shot V-5 which followed Shot V-6 due to a change in AEC schedules. The purpose of having these Marine officers attend the V-6 shot was to familiarize them with atomic phenomena so that they could disseminate the information to the Marine units. The effectiveness of having commanders view a detonation prior to directing troops in an atomic exercise was well demonstrated in later operations.

The observers, totaling 63 personnel, departed Camp Desert Rock at 0300 hours, 11 April for News Nob, a distance of twenty five (25) road miles. The convoy arrived at News Nob at 0412 hours without incident.

Vehicles were parked in a parking area 100 yards from News Nob near the observation point. A member of the Camp Desert Rock Instructor Group gave all observers a twenty minute briefing and orientation on the burst phenomena at the observation point.

Since the burst was small, and the observers were 10 miles from the detonation, no shelter was necessary for personnel or equipment. The observers were required to face away from the tower immediately prior to H-hour and remain faced away until after the flash of detonation. The observers witnessed the formation of the mushroom cloud and the subsequent action of the fireball very clearly. No blast wave was felt, but a sharp crack of sound reached the observation point. Four Marine helicopters (H19 type) participated in the shot and were clearly seen from the observation point on News Nob.

The return trip to Camp Desert Rock was completed without incident at 0540 hours. No assistance from the Rad-Safe personnel was required at any time during the operation. No measurable radiation was received at the observation point.

Communications for the operation consisted of direct telephone lines into the Proving Ground Command Post and into the AEC switchboard. A loudspeaker system tied into the AEC command post circuit was also used to broadcast the count down sent out by an AEC announcer from the control point.

HQ CAMP DESERT ROCK
LAS VEGAS (872536) NEV
011200 June 1953

Annex 7 (SHOT VICTOR 7) to Final Report
EXERCISE DESERT ROCK V

I. GENERAL

Troop observers arrived at Camp Desert Rock during the period 21-24 April. Arrival times were so separated that less than one half of the observers were present the first day the orientation course was conducted. Troops from the Second, Fourth, Fifth and Sixth Armies closed in camp on 22 April and were organized into two (2) RCT's for participation in the tactical maneuver.

A rehearsal of the tactical maneuver and the observer program was conducted in the Yucca Flat area on 23 April. Actual site positions to be occupied on shot day were utilized. The Control Group departed Camp Desert Rock for the forward area at 0700 hours and all march units closed in the exercise area, 33.2 miles from camp, at 0945 hours.

An on site orientation program was conducted by a member of the Instructor Group. Time selected for H-Hour was 1030 hours. At this time all personnel positioned themselves in the trenches and troop units started the simulated attack at 1035 hours.

The attacking forces moved very rapidly and at the end of thirty five (35) minutes had advanced a distance of 2500 yards. Attacking waves of troops formed solid masses in some instances and the commander experienced difficulty in controlling his units. Upon arrival at the 2000 yard line, the attack was halted and this completed the tactical phase of the maneuver.

Troop units and observers were taken through the equipment display area. Later the observer group was taken to the site of Shot V-5 (18 April) to observe damage incurred on equipment by a previous detonation. Return motor movement to camp started at 1300 hours and the last march unit closed in Camp Desert Rock at 1505 hours. No unusual incidents occurred during the rehearsal.

The control group departed camp for Shot V-7 at 0030 hours 25 April. Transportation requirements to move the control group, observers and troops to the shot site totaled 179 vehicles. All march units and personnel closed in the entrenchment area at 0322 hours. Vehicles were moved to a parking area 5.9 miles from ground zero.

A member of the Instructor Group conducted a pre-shot orientation from 0330 to 0420 hours. Information pertaining to an atomic device detonated from a tower was presented to the observers and troops.

The Exercise Director ordered all personnel to enter the trenches at H minus 15 minutes and at H minus 2 minutes all personnel were instructed to crouch low in the trenches. A siren warning of 30 seconds duration was sounded at this time. With 90 seconds remaining prior to the detonation, an Atomic Energy Commission spokesman from the command post took over on the public address system and counted off the remaining time at 30 second intervals until reaching H minus 10 seconds. At H minus 5 seconds, the final count down started with the familiar "4, 3, 2, 1 and NOW." It was now 0430 hours.

A bright light, of approximately 3 seconds duration, was noted at the time of detonation. The ground shock was heavy, and the earth appeared to roll for a moment. Noise accompanying the blast was deafening, loudest of this series of shots. Dust conditions following the blast and debris falling into the trenches obscured the vision of personnel in the trenches.

As usual for tower shots, the fireball was engulfed in a large dust cloud initially. The cloud rose steadily and actually formed the well known "atomic mushroom." This was by far the most picturesque atomic cloud to be observed, from a tower shot, in this series of shots. An initial radiation intensity of 5 r/hr registered on survey meters in the trenches; however, the radiation lasted for such a short time, the initial radiation dose was less than 25 mr.

Both RCT's started the attack at 0444 hours towards objectives 4000 yards to the north. The RCT on the east (R) advanced to within 2000 yards of ground zero at 0600 hours. At this time the attack was halted by the Rad-Safe monitors due to a reading of 2.5 roentgens at this point. The RCT on the west (L) encountered no areas having a high radiation intensity and advanced until the attack was halted for other reasons.

Upon completion of the tactical phase of the maneuver, observer and troop personnel were moved through the equipment and animal display area. Movement forward was limited to the 3000 yard line due to radiation levels encountered.

Eight (8) volunteer Army and Navy officers were positioned in trenches 2000 yards from ground zero during the blast. Telephone communication was established from the control trench to the volunteers and the Exercise Director was able to keep all volunteers informed prior to, during and after the shot. All volunteers withstood the blast without incident.

The Marine Corps Helicopter Group (H-19 type) conducted experiments during the shot. A full report on this participation is included in paragraph VIII.

An army helicopter (H-23) was used for reconnaissance purposes after the detonation. It was possible to observe the equipment and animals in the forward area during these flights. Another helicopter was available for evacuation purposes.

Return movement to Camp Desert Rock started at 0625 hours and all march units and personnel closed in camp at 0957 hours without incident.

Sand bags in the entrenchment area, 4000 yards from ground zero were singed. Joshua trees, located 400 yards west and 200 yards north of the entrenchment area were ignited shortly after the detonation.

Of unusual interest, occurring as a result of this shot, was the caving in of a C-4 type bunker at the 1500 yard line. A sheep, tied to a stake, was placed in this bunker on 24 April, prior to time of cave-in. On 13 May, a working party removed the top portion of the bunker and the trapped sheep leaped from the emplacement. Even though the animal had been without food and water for nineteen (19) days, it appeared in good condition and was able to walk. The animal recovered completely and was used in an animal display for a subsequent shot.

Participating in the exercise were 3,102 military and 24 civilian personnel, a total of 3,126 persons.

At ground level, in the entrenchment area, temperature was recorded at 53 degrees Fahrenheit. Wind velocity, from a direction of 340 degrees, true north, was 5 knots per hour and visibility was 50 miles. Measured humidity was 26 percent and atmospheric pressure was 870 millibars.

II. INTELLIGENCE AND SECURITY.

The major difficulty encountered during the convoy movement was the identification of vehicles within the march units. Only two march units dimmed their lights at check points. Signs were dusty and hard to decipher.

Once again observers arrived without security clearance indicated on their orders. This was corrected by sending messages to observers home station for clearances.

Late arrivals created a problem as to checking attendance at orientation briefings in that rosters could not be completed prior to check-in time at the theater. No security violations were reported for the group attending this shot.

III. INSTRUCTOR GROUP.

In preparation for Shot V-7, the Instructor Group presented three types of orientation programs. An eight hour period of SECRET classification was presented to those troop observers who arrived at Camp Desert Rock on or before 22 April. A four hour periods of orientation was presented to those observers who arrived after 22 April, and another four hour presentation was provided on the CONFIDENTIAL level for RCT's and all observers not cleared above the CONFIDENTIAL access level. In general, the change in arrival plans of certain contingents of observers was such that they arrived at Camp Desert Rock on the day prior to the shot rather than three days before caused a hurried rearrangement of orientation programs. Each group, however, received adequate orientation prior to the shot, though not the full eight hours originally planned.

Two hundred and ten (210) observers for Shot V-7 arrived at Camp Desert Rock prior to 0700 hours 22 April. All RCT personnel were present prior to this time. The Instructor Group presented a four hour CONFIDENTIAL orientation for RCT ABLE during the morning of 22 April and for RCT BAKER in the afternoon. All classes were conducted in the open air amphitheater. Ample seating was available for the full twelve hundred men oriented at one time. No difficulty was encountered in hearing

the instructor from any part of the amphitheater, the Signal Corps amplifiers completely filling the requirement for sound. Training aids such as charts set up on the stage could be seen very well from the rear of the amphitheater.

The 210 observers arriving on 21 April received a four hour portion of the standard eight hour orientation for observers on the SECRET level beginning at 0730 and concluding at 1155 hours, 22 April. For this same group, two films were shown during the afternoon. "Operation Greenhouse", a documentary of the AEC tests on Eniwetok Atoll in the spring of 1951, and "Operation Tumbler Snapper", a documentary of military participation in the spring tests at Nevada Proving Ground in 1952, were screened on a voluntary basis. A total of one hundred and sixty hour (164) observers attended the film showing.

On 23 April, a rehearsal of the troop and observer participation in Shot V-7 was conducted. Although one half of the observers had not yet arrived, those present went through the rehearsal and were able to pass on instructions and assistance to later arrivals. Both BCT's took part in the rehearsal. In the trench area, at a time simulated as H minus 20 minutes, a member of the Instructor Group carried out a terrain orientation followed by instructions for procedure in the trenches prior to H hour. Following H-Hour, an instructor escorted the observer group and other instructors conducted each BCT through the display areas so that a basis for comparison of damage could be made following the actual shot. It was carefully pointed out to all that contamination might deny the area to observers and troops on shot day, nearer the tower than 1500 or 2000 yards.

On 24 April, those observers who had received the first four hour period of orientation on 22 April were presented the second four hours. During the afternoon of 24 April, 250 observers were oriented in weapon delivery means available to the services and in tactical employment of atomic weapons. At 1930 hours, 24 April, late arrivals and general officers were briefed as to the tactical problem of the exercise and, in general, procedures to follow while in the forward area. At this time technical questions, within the limits of SECRET classification, were answered by a member of the Instructor Group.

From H minus 60 minutes to H minus 2 minutes on shot day, a member of the Instructor Group conducted a pre-shot orientation of a general nature as to terrain, safety, and air participation in the exercise. Following the shot, instructors conducted each BCT and the observer group through the display area to the 2000 yard line. Closer approach was prohibited by radiation levels. Damage results at ranges closer than 2000 yards were obtained by the instructors and presented to all personnel, though viewing by all was not possible.

IV. SIGNAL COMMUNICATION.

The layout of the trench area for this shot was generally the same as for previous shots in the forward area and the communication installations generally conformed to the plan followed in prior shots detonated in this area.

Three speaker poles were installed in the trench area, mounted with four speakers pointing in four directions to cover all troops within the general area of the speaker pole. Each group of four speakers were fed from one public address system and the three systems were all tied in to one central system in the Exercise Director's trench for control. This installation proved to be very satisfactory and is now the standard installation used in all shots.

Telephones were installed in the forward trench of each BCT commander. In addition, telephones were installed in the observers trench, the parking area and the heliport. Communication with Camp Mercury and Camp Desert Rock was provided through the forward switchboard located in the trench area.

Normal radio communication was installed with the Rad-Safe officers in one net, the Exercise Director and the BCT commanders, the parking area and the heliport in another net and each of the BCT's in a separate net.

Four mobile public address systems were used for orientation purposes in the display area. The public address systems worked out very well and were in place ready for operation prior to the arrival of the troop units. Two power megaphones were used by the BCT commanders for oral orders to their respective units and proved quite satisfactory.

V. RAD-SAFE.

No changes were made in the organization and operation of the Camp Desert Rock Rad-Safe orga-

station. Pre-shot tasks included conducting a 6 hour radiological monitor refresher course and test for participating army units.

This shot was characterized by an apparent higher yield and more wide-spread radiological contamination than previously encountered. There was little wind at shot time. The cloud drifted eastward with a heavy fall-out in that direction. Radiological Safety monitors for the troop units were in position at H plus 5 minutes in spite of the heavy dust cloud which hung over the area. The display area survey teams reached their initial points at approximately H plus 15 minutes. The 2.5 r/hr intensity was reached on the east (R) side of the display area at 2200 yards from Ground Zero with the 5 r/hr intensity being reached at 2000 yards. On the west (L), the 2.5 r/hr intensity was reached at 2500 yards with the 5 r/hr intensity at 2100 yards. Intensities in the troop trench area slowly rose to 120 mr/hr but quickly receded to about 30 mr/hr. Due to the high intensities encountered in the test area and on the access roads, final personnel and vehicle monitoring was impossible in the test area. Troops and vehicles were moved to the decontamination station at Yucca Pass and to Parking Area A (837925) for field decontamination and final monitoring.

The performance of the unit CBR personnel as radiological monitors was considerably improved over the previous army units. Troop participation from the stand point of radiological safety was excellent.

Rad-Safe operations in the field of providing for the collection of information were continued on the same scale as for Shot X-5, except no pressure gauges were available for this shot.

Post shot evaluation of the operation indicated that the corrective measures taken after Shot X-5 were effective.

Procedure:

Heat sensitive paper was placed in positions exposed to direct thermal radiation and in positions shielded from direct radiation but exposed to reflected or scattered radiation at 500 yard intervals from ground zero from 500 yards to 3000 yards. The exposed papers were placed in vertical position so as to receive near maximum radiant energy. The sheltered ones were placed in a horizontal position, face up to measure radiation in the trenches. At 1500 yards and 2000 yards papers were exposed in a horizontal position on the surface of the ground with no thermal shielding.

Results:

Values given are approximations:

Distance from GZ in yards	Sheltered Position	Exposed Position
500	Lost	Paper destroyed, more than 34 cal/cm^2.
1000	Lost	Paper destroyed, more than 34 cal/cm^2.
1500	No effect, less than .45 cal/cm^2.	Vertical paper destroyed, more than 34 cal/cm^2. Horizontal paper, about 5 cal/cm^2.
2000	No effect, less than .45 cal/cm^2.	Vertical paper, 25 cal/cm^2. Horizontal paper, about 5 cal/cm^2.
2500	No effect, les than .45 cal/cm^2.	4 cal/cm^2.
3000	No effect, less than .45 cal/cm^2.	25 cal/cm^2.

Immediate Radiation in roentgens received in emplacements.

Distance from GZ in yards	C1 Exposed post	C2 Shallow slit Trench	C3 Deep slit Trench	C4 1 Man emplace-ment	C5 2 Man emplace-ment
1500	1150.0	lost	lost	24.5 r	lost
2000	175.0	lost	80.0	3.2	4.6
2500	22.0	18.5	11.0	.2	1.0
3000	5.6	1.7	.7	.5	.5
3500	.95	.25	.1	0	0

Badges placed in 6 ft trenches at 1500 yards recorded 28.1 r. The film badge in the 1750 yard trench was lost. Trench at 2000 yards received 8.75 r.

These data represent the immediate radiation personnel protected by the emplacements and unprotected at the same distance from ground zero would have received.

Badges were exposed in National Bureau of Standards holders.

VI. MEDICAL.

The medical support for this operation was carried out in an identical manner to that for W-5. The same plan for emergency medical care for the volunteer group was prepared, but as no casualties occurred it was not implemented. The only casualty reported was one of the enlisted men from EDT Baker. This man developed a rather severe nose bleed just prior to the detonation. He was treated immediately after H-Hour. It was felt that he should not participate with the troops and he was therefore held at the aid station until the conclusion of the exercise.

Medical evaluation of test items:

On the day prior to the detonation 37 sheep were placed at varying distances from ground zero. Commencing at 500 yards five sheep were placed at each 500 yard interval extending through 3500 yards from ground zero. The sheep employed at each of the 500 yard intervals were placed one to each C-type position (C-5, C-6, C-7, C-8 and C-9). In addition to the above positions there were two special trenches, one at 1500 yards and one at 1700 yards. One sheep was placed in each of these two positions.

The two special trenches at 1500 yards and 1700 yards are conventional type trenches 6 ft. in depth similar in design to the trenches used by volunteer observers.

The veterinary officer and one enlisted man accompanied the control group. Immediately following the detonation a medical technician accompanied by a monitor moved forward by truck to observe the sheep. A veterinary technician accompanied the loading party later in the morning to aid in rendering a tentative evaluation of the effects of the detonation in relation to the effects incurred by the sheep. When the sheep were returned to Camp Desert Rock a final evaluation was rendered by the veterinary officer. The veterinary officer, because of previously acquired radiation, was not permitted to advance past the control trench, so it was necessary to follow the above procedures in relation to evaluating the effects incurred by the sheep.

Most of the evaluation results are covered in the evaluation forms or the picture captions, but following are some of the more pertinent results.

The sheep at 3500 yards were all found to be normal.

The sheep at position C-9, 3000 yards had moderate wool burns. The other sheep at this distance were normal.

At 2500 yards the sheep at position C-9 had second degree burns on the face and wool burns covering 1/4 of the body area. The sheep at position C-7 had moderate wool burns. The sheep at positions C-5, C-6 and C-8 were all normal.

At 2000 yards the sheep at position C-9 had second degree burns on the ears and extensive wool burns covering 1/2 the body area. This animal suffered no other ill effects until epilation, i.e., loss of hair, appeared 8 May. This animal has as yet shown no inappetence and it is considered to have a better than average chance to effect a recovery. The dose of radiation this animal received was 253 r. The sheep at position C-8 had third degree burns on the face and moderate wool burns.

It suffered no other ill effects until epilation appeared 10 May. This animal has, as yet, shown no inappetence and it is believed that it will recover. The radiation dosage for this animal was 175 r. The sheep at position C-7 suffered no visible effects from the detonation. Epilation ensued 10 May. This animal has, as yet, shown no inappetence and it is believed that it will recover. The radiation dosage for this animal was 113 r. The sheep at position C-5 and C-6 were both normal.

At 1500 yards the sheep at position C-9 had third degree burns on the face and extensive wool burns. It refused food and water after being returned to the sheep pens and died the night of 26 April. The data on the amount of radiation received by this animal was lost, but it is assumed to have received in excess of 1000 r. The sheep at position C-8 had moderate wool burns. It remained normal until 3 May when epilation ensued. This animal has not shown any inappetence, but it is inconceivable that this animal will survive since the radiation dosage it received was 950 r. The sheep at position C-6 and C-7 have shown no visible effects. The radiation dosage reported for them was 464 r and 427 r respectively. At position C-5 the entrance to the bunker collapsed so the sheep is assumed to have died from suffocation.

The sheep in the conventional type trenches at 1500 and 1700 yards initially suffered no visible effects. Epilation appeared in the sheep placed at 1700 yards on 3 May. It has shown no inappetence, so it is assumed this sheep will recover. The radiation dosage received by this animal was 173 r. Epilation appeared in the sheep placed at 1500 yards on 10 May. This sheep has shown no inappetence, so it is assumed it will recover. The radiation dosage received by this sheep was 222 r. Both sheep have previously been exposed to an atomic detonation.

At 1000 yards the sheep at position C-9 was killed by blast effects. It was blown back approximately 50 yards. The sheep at position C-8 was killed by blast effects. It was blown clear of the trench and back approximately 40 yards. The sheep at position C-7 had extensive wool burns on the back. It developed in-coordination the morning of 26 April and became prostrate the afternoon of 27 April. Death occurred the night of 27 April. Death was attributed to acute radiation sickness. The radiation dosage this animal received was 10,735 r. The sheep at position C-6 initially suffered no visible effects. It became prostrate the afternoon of 28 April and died the night of 28 April. There was a complete absence of external injuries, and this can be considered a typical case of acute lethal radiation sickness. The radiation dosage received by this animal was 4,638 r. The sheep at position C-5 initially suffered no visible effects. Epilation appeared 10 May. This animal has shown no inappetence, but it is doubtful that this animal will recover since the radiation dosage received was 623 r.

At 500 yards the sheep at position C-6, C-7, C-8 and C-9 were all killed by blast effects. At position C-5 the bunker was collapsed, so it is assumed the sheep at this position died directly from blast effects or indirectly from suffocation.

Total number of sheep exposed thirty-seven; eight killed directly or indirectly from blast (suffocation); three died from acute lethal doses or radiation. At the present time twenty-six of the original thirty-seven are still alive. It is considered that at least two of this total will eventually die.

It will be noted that the picture section of this report is rather brief in comparison with the two proceeding reports. This is due to the fact that there was too much radiation present in the display area, and consequently a photographer could not enter this area for several days following the detonation.

VII. VOLUNTEER OBSERVER PROGRAM.

Volunteer observer trenches were located 2000 yards from ground zero on an azimuth of approximately 180°. Trenches were 6 feet deep and 3 feet wide. One trench was revetted with sandbags and timber. The second was an unrevetted trench with a sandbag parapet.

The volunteers consisted of 7 Army Officers and 1 Naval Officer. All officers were well indoctrinated in the field of special weapons and capable of calculating effects of atomic weapons, utilizing TM 23-200, dated 1 Oct 1952. After careful calculation all agreed that the trenches were located at a safe distance for a weapon of the yield predicted.

The atomic weapon exploded was an experimental device placed on a 300 foot tower. The predicted yield was estimated as 35 KT, plus or minus 5 KT. Calculations of volunteers were based on the highest predicted possibility, 40 KT. It is estimated that the actual yield, although not available at this time, will probably exceed the highest predicted possibility by as much as 25 percent.

Weather data for Ground Zero at the time of burst were:

Temperature	53 degrees F
Wind Direction	040 degrees T
Wind Speed	7 Knots
Visibility	50 miles
Pressure	870 millibars

Volunteers reported the following effects were noted:

Initial flash. The light was reported as being of great intensity. Objects in the trench could not be distinguished during the period of greatest intensity. Normal vision returned immediately after the light subsided.

Thermal effects. All observers reported feeling heat from above at the time of the light. This heat was not intense but was distinctly noticeable. There were no instruments available for measuring the amount of heat received in the trench.

Blast effects. The air blast was reported as a very loud sharp noise. Concussion pressure was felt but no pain or after effects were noted. Sand and dirt blown into the trenches by the air blast.

Ground shock. The ground shot was described as being short vibration-like motions similar to a mild earthquake. The duration of the shock was short and no separate pulses were felt.

Nuclear radiation effects. First reading noted on radiac instruments gave a rate of 100 roentgens per hour. During the 5 minute period the volunteers remained in the vicinity of the trenches this rate fell to 20 roentgens per hour. As the group moved toward the road, to meet vehicles sent forward to evacuate them, they passed through a heavy fall out of sand sized particles carrying a radiation reading of 50 roentgens per hour. As they evacuated to the rear radiac instrument readings declined rapidly to 1 roentgen per hour 1000 yards in rear of the trenches they had occupied. Dosimeters carried by the volunteers registered an average total dosage of 10.4 roentgens. Developed film badges registered total dosages ranging from 11.7 to 16.3 roentgens. The wide range of the readings of these film badges raises a question as to the reliability that should be assigned to readings so obtained.

Miscellaneous effects. At the instant of first light several observers felt a shock variously reported as similar to an earth tremor or air blast. One observer holding a telephone, connected to a direct line between volunteer trench and control trench, received a distinct electric shock and a tingling sensation about the neck. The operator holding the telephone in the control trench (at 4000 yards from Ground Zero) reported receiving a shock equivalent to that received when holding a bare 110 volt electric wire. All observers reported a generally reduced efficiency during the first 5 minutes after the blast because of heavy dust conditions.

The following conclusions were made by the volunteer observers:

That troops would gain very little by being entrenched closer to Ground Zero than 4000 yards during orientation and indoctrination exercises because:

They can feel the effects of the detonation at this distance as well as they could at a closer point.

They can better observe the fireball and mushroom cloud.

They are sufficiently removed from the heavy dust and possible radiation hazard.

That the present volunteer observer program, with present mission and limiting criteria, has served its purpose and should be discontinued.

That a volunteer program of this type with a mission of indoctrination for personnel having special weapons training or assignments with special weapons programs would be worthwhile.

That future volunteer programs would have greater value if volunteers were positioned in a variety of standard field fortifications and combat vehicles approximating actual combat conditions.

That instrumentation placed in the trenches to record pressures, heat, ground shock, and nuclear radiation would be of assistance in evaluating observer's reactions.

MARINE CORPS AIR (HELICOPTER).

Marine Helicopters "A" and "B" were positioned at approximately 12,440 yards from ground zero. Helicopter "A" was positioned with its left side exposed and "B" was facing the blast. From one (1) minute prior to the blast until after the passage of the shock wave, Helicopters "A" and "B" hovered at about ten (10) feet above the ground.

The pilots of Helicopters "A" and "B" protected their eyes by lowering the bills of their caps so as to shield their eyes from the flash. The pilots experienced no flash blindness. The co-pilots were standard 4.2 density goggles at the time of detonation and were prepared to assume control of the helicopter should the pilot be blinded by the flash.

Helicopters "A" and "B" were subjected to .59 psi at their position. The control of the helicopters was not effected; however, a window in the passenger compartment of Helicopter "A" was blown out of the rubber molding. No other damage occurred.

After passage of the shock wave, Helicopters "A" and "B" proceeded toward the shot area. Helicopter "A" skirted the dust column noting radiological conditions up to 50 r/hr. Helicopter "B" proceeded to a position 2000 yards west of ground zero and landed. The monitor in "B" disembarked and continued on foot to a position 950 yards from ground zero recording radiological readings up to 10 r/hr.

Helicopter "C" took off from Camp Desert Rock twenty two (22) minutes prior to detonation and arrived at the south end of Yucca Lake two (2) minutes prior to detonation. Helicopter "C" was continuing its flight toward the shot area at the time of detonation and during the passage of the shock wave maintaining 400 feet altitude and 60 knots indicated air speed. The pilot protected his eyes from the direct rays of the flast by lowering the bill of his cap and concentrating his vision on the flight instruments. No flash blindness was noted. The co-pilot wore standard 4.2 density goggles. The passage of the shock wave, which subjected "C" to .55 psi, did not effect the control or harm the helicopter in any way.

After passage of the shock wave, Helicopter "C" proceeded around the upwind side of the dust column and landed about 2200 yards northwest of ground zero.